

WATER BALANCE EXAMPLE

Additional Comments

A. Precipitation

- may be obtained from local weather stations and adjusted as necessary for specific conditions.
- must be specified in a frequency appropriate to problem; e.g., an average annual WB requires monthly data, whereas a monthly WB requires daily data.

B. Runoff

- estimated from SCS curve number information or from local streamgaging stations.

C. ET

- this represents consumptive use of water stored in the soil profile by vegetation and evaporative losses of water to the atmosphere. In mountain regions, ET methodology must consider such factors as ground slope, aspect, elevation, and vegetation in addition to mean temperatures and solar radiation.

D. AWC

- Available Water Capacity of soil.
- typically, this is represented by $\int_0^{D_r} (\theta_{FC} - \theta_{pwp}) dz$ where D_r is the rooting depth. θ_{FC} and θ_{pwp} vary with depth due to variation of shale compaction and vegetation root density with depth.

E. Deep Percolation

- for this example we calculate long-term average annual seepage through the reclamation zone, hence, the shale pile.
- note that the average annual $\Delta S = 0$, however, ΔS has a significant role in monthly calculations.

In summary, water balance concepts often provide an excellent first approximation of water movement in the hydrologic cycle, and are an important tool for analyzing hydrologic processes.



Table 3. Estimated Monthly Evapotranspiration Rates

Month	K_c ¹	ET_p ² (in.)	ET ³ (in.)
Jan	0.50	0.69	0.37
Feb	0.50	0.91	0.49
Mar	0.50	1.51	0.81
Apr	0.60	1.75	1.05
May	0.80	3.00	2.40
June	0.80	5.10	4.08
July	0.80	6.25	5.00
Aug	0.71	5.21	3.70
Sept	0.53	3.24	1.72
Oct	0.50	1.91	0.96
Nov	0.50	1.11	0.59
Dec	0.50	0.72	0.38

¹ Water use coefficients (after Wymore, 1974)

² Potential evapotranspiration (after Wymore, 1974)

³ $ET = K_c \cdot ET_p$

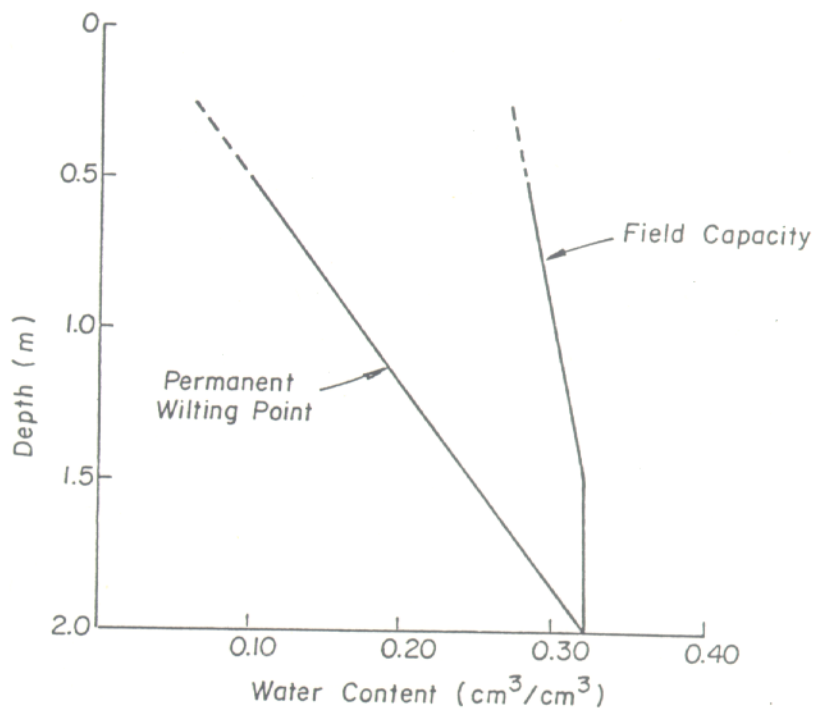


Figure 2. Water retention relationship for Union retorted shale (Adapted from Wymore, 1979)

Table 4. Calculation of Deep Percolation from Water Balance Consideration

Month	P (in)	R (in)	ET (in)	P-R-ET (in)	S (in)	D* (in)
Jan	1.53	0	0.37	1.16	4.25	0
Feb	1.53	0	0.49	1.04	5.29	0
Mar	1.67	0	0.81	0.86	5.70	0.45
Apr	2.03	0.06	1.05	0.92	5.70	0.92 0.92
May	1.55	0.05	2.40	-0.90	4.80	0
June	1.65	0.05	4.08	-2.48	2.32	0
July	1.57	0.02	5.00	-3.45	0	0
Aug	2.18	0.02	3.70	-1.54	0	0
Sept	1.77	0.01	1.72	0.04	0.04	0
Oct	1.57	0.01	0.96	0.60	0.64	0
Nov	1.44	0	0.59	0.85	1.49	0
Dec	1.98	0	0.38	1.60	3.09	0
Annual	20.47	0.22	21.55	-	-	1.37

* Determination from water balance equation, $D = P - R - ET - \Delta S$